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Publication number:

0 496 167 A1

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EUROPEAN PATENT APPLICATION

21 Application number: **91311889.9**

51 Int. Cl.⁵: **E02D 11/00, E02D 7/18**

22 Date of filing: **20.12.91**

30 Priority: **24.01.91 JP 7283/91**

43 Date of publication of application:
29.07.92 Bulletin 92/31

84 Designated Contracting States:
CH DE FR GB IT LI NL

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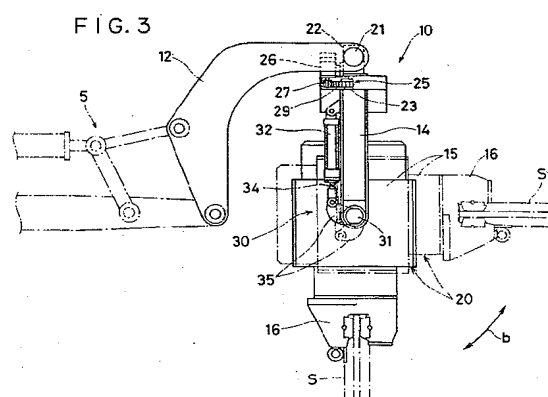
54 **Vibrating pile driver.**

57 A vibrating pile driver comprises a coupling arm unit 12 attachable to the operational arm of a construction machine such as a hydraulic shovel to which is coupled a hanger unit 14 rotatable relative to the coupling arm unit 12 about a horizontal and a vertical axis.

A main body 20, with a vibrator and a chuck for holding a pile to be vibrated is coupled with the hanger unit 14 and is rotatable about a horizontal axis relative thereto.

A first rotation driving mechanism is provided between the coupling arm unit and the hanger unit to relatively rotate them about the vertical axis and/or a second rotation driving mechanism is provided between the hanger unit and the main body to relatively rotate them about the horizontal axis.

The positional changes of the hanger unit 14 and the main body 20 may be automatically performed by a remote control rapidly and easily, and further, with safety to improve the mobility and operativity of the piling, and the pile installation and removal.



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The present invention relates to a vibrating pile driver of a construction machine comprising a coupling arm unit attached to the operational arm of the construction machine (e.g., hydraulic shovel, etc), a rotary hanger unit attached to the coupling arm, and a vibration generating apparatus consisting of a main body and a chuck which is attached to the rotary hanger unit.

Generally, a vibrating pile driver actuates its vibrator to vibrate a chuck in the direction (usually, vertical direction) of piling while the pile is being held by the chuck to perform its operation in such a manner that the pile is sunk (driven) into the ground with the weight of the pile driver and the pile itself while frictional resistance between the pile and the ground is kept small. Also, as it is possible to keep the frictional resistance between the pile and the ground small by vibration, such operation is utilized for drawing from the ground the pile which has been driven thereinto.

The type of a vibrating pile driver of this kind is generally such that the driver is suspended from a crane or the like. However, in order to improve the mobility and the handling operativity, the applicant hereof has developed a vibrating pile driver 50, as shown in Fig. 4 and Fig. 5, which comprises a coupling arm unit 12 attachable to the operational arm 5 of a construction machine such as a hydraulic shovel, etc., which is structured to allow its position to be shifted; a hanger unit 14 connected to this coupling arm unit 12, which is relatively rotatable in the vertical plane and the horizontal plane; a main body 20 having a vibrator 15 for generating the exciting power and a chuck 16 for holding a pile while being vibrated by the vibrator 15, which is connected to the hanger unit 14 and is relatively rotatable in the vertical plane.

In a vibrating pile driver as shown in Figures 4 and 5 the coupling arm unit 12, hanger unit 14, and main body 20 can interrelatedly change the positions thereof to adjust arbitrarily the direction of a pile or the direction of the piling operation, and at the same time, to perform the piling operation rapidly without a problem in a narrow place such as a farm road or an alleyway or in a place where buildings are in the immediate vicinity. Moreover, at the time of installing, removing, or replacing the pile, it is possible to install the pile sideways (in the horizontal direction) or to remove the pile from the chuck 16 after having rotated the main body 20 in the vertical plane to position the main body 20 horizontally against the hanger unit 14. Hence, these operations can be performed with ease and safety.

However, in the above-mentioned vibrating pile driver 50, the rotation of the hanger unit 14 against the coupling arm unit 12 in the horizontal plane and the vertical plane are respectively performed by an

operator manually. Therefore, there are still problems encountered that these operations are not only troublesome and complicated, but present some aspects which require further consideration in respect of the safety.

According to the present invention there is provided a vibrating pile driver comprising:

a coupling arm unit attachable to the operational arm of a construction machine such as a hydraulic shovel;

a hanger unit coupled with said coupling arm unit and rotatable relative to said coupling arm unit in a vertical plane and also about a vertical axis;

a main body, having a vibrator and a chuck to be vibrated by said vibrator and for holding a pile, coupled with said hanger unit and rotatable about a horizontal axis relative to said hanger unit; and

a first rotation driving mechanism between the coupling arm unit and the hanger unit to relatively rotate them about the vertical axis and/or a second rotation driving mechanism between the hanger unit and the main body to relatively rotate them about the horizontal axis.

In the vibrating pile driver of the present invention the hanger unit may be rotated relative to the coupling arm unit automatically by the first rotation driving mechanism. Also, the main body may be rotated relative to the hanger unit automatically by the second rotation driving mechanism. Hence, the positional changes of the hanger unit and main body can be performed automatically by the remote control rapidly and easily, and further, with safety, so that the mobility and operativity of the pile driving, the pile installation and removal, etc. can be improved.

The present invention will be more clearly understood from the following description, given by way of example only, with regard to the accompanying drawings in which:

Fig. 1 is a front view showing an embodiment of a vibration generating apparatus according to the present invention.

Fig. 2 is a plan view showing the embodiment shown in Fig. 1.

Fig. 3 is a side view showing the embodiment shown in Fig. 1.

Fig. 4 is a view showing a conventional vibrating pile driver.

Fig. 5 is a view illustrating the operation of the positional changes of the conventional example shown in Fig. 4.

Description of the reference marks

- | | |
|-----|--------------------------------|
| 10. | vibrating pile driver |
| 12. | coupling arm unit |
| 14. | hanger unit |
| 15. | vibration generating apparatus |

- 16. chuck
- 20. main body
- 25. the first rotation driving mechanism
- 26. hydraulic motor
- 30. the second rotation driving mechanism
- 32. hydraulic cylinder

Fig. 1 is a front view showing an embodiment of a vibration generating apparatus according to the present invention. Fig. 2 and Fig. 3 are a plan view and a side view showing the apparatus respectively. In these figures, the units corresponding to those of the conventional vibrating pile driver 50 shown in the aforesaid Fig. 4 and Fig. 5 are referenced by the same marks, and any duplicating descriptions thereof are omitted.

A vibrating pile driver 10 of the present embodiment is provided with a coupling arm unit 12 attachable to the operational arm 5 of a construction machine such as hydraulic shovel, etc., which is structured to allow its position to be shifted as in the conventional driver described earlier, and one end of a suspension shaft 22 is fitted in a supporting shaft 21 mounted at the leading end of this coupling arm 12 so that the suspension shaft can be rotated in the horizontal plane. To the other end of the suspension shaft unit 22, a hanger unit 14 is supported through a bearing unit 23 so that the hanger unit can be rotated in the horizontal plane.

Then, a first rotation driving mechanism 25 is inclusively mounted between the suspension shaft unit 22 and the hanger unit 14 to couple them. The first rotation driving mechanism 25 includes a hydraulic motor 26 fixed to the suspension shaft unit 22, a driving gear 27 fixed to the rotational shaft thereof, a driven gear 29, which is fixed to the bearing unit 23 integrated with the hanger unit 14, to engage with the driving gear 27.

Also, in the hanger unit 14, a main body 20 is supported through a pair of rotational shafts 31 so as to be relatively rotated in the vertical plane. The main body 20 comprises a vibrator 15 which generates the exciting power by the supply and exhaust of the activated hydraulic pressure from the hydraulic pressuring unit externally arranged (not shown), and a chuck 16 installed at the lower end of this vibrator 15, which causes a pile S to be vibrated vertically in a state where the pile is being held by the chuck. The main body 20 as a whole is structured to rotate integrally with the rotational shaft 31.

Subsequently, a pair of second rotation driving mechanism 30 are inclusively arranged between the hanger unit 14 and the main body 20 to couple them. Each of the second rotation driving mechanisms 30 is structured to include a hydraulic cylinder 32, the trailing end of which is rotatably fixed to the hanger unit 14, and a rocking arm 35, the one end of which is rotatably connected to the

leading end of the piston rod 34 of the hydraulic cylinder 32 while the other end thereof is fittedly fixed to the rotational shaft 31 connecting the hanger unit 14 and the main body 20

The hydraulic motor 26 of the above-mentioned first rotation driving mechanism 25 and the hydraulic cylinder 32 of the second rotation driving mechanism 30 are respectively operated, for example, by the activated hydraulic pressure from the hydraulic pressuring unit common to the vibrator 15, for example. The operational control is therefore performed, for example, by a remote control through an operation board provided in the driver's seat, etc., of the hydraulic shovel. With the hydraulic motor 26 being in motion, the hanger unit 14 is rotated in the horizontal plane integrally with the driven gear 29 as indicated by arrow a in Fig. 2. Then, the positions of the hanger unit 14 and the main body 20 are shifted against the coupling arm unit 12. On the other hand, when the hydraulic cylinder 32 is actuated, the rocking arm 35 is rotated integrally with the rotational shaft 31 as indicated by arrow b in Fig. 3. Thus, the position of the main body 20 is shifted in the vertical plane.

In this way, the positional changes of the hanger unit 14 and the main body 20 are automatically performed by the remote control rapidly and easily, and further, with safety, thus making it possible to improve the mobility and operativity of the piling, and the pile installation and removal, etc.

In this respect, the structures, etc. of the first rotation driving mechanism 25 and the second rotation driving mechanism 30 are not limited to those set forth above, and as a matter of course, the hydraulic motor 26 can be replaced by an electric motor while a pneumatic cylinder can be employed in place of the hydraulic cylinder 32.

Claims

1. A vibrating pile driver comprising:
 - a coupling arm unit attachable to the operational arm of a construction machine such as a hydraulic shovel;
 - a hanger unit coupled with said coupling arm unit and rotatable relative to said coupling arm unit in a vertical plane and also about a vertical axis;
 - a main body, having a vibrator and a chuck to be vibrated by said vibrator and for holding a pile, coupled with said hanger unit and rotatable about a horizontal axis relative to said hanger unit; and
 - at least one rotation driving mechanism selected from:
 - a first rotation driving mechanism provided between said coupling arm unit and said hanger unit for relatively rotating them about the

horizontal axis; and

a second rotation driving mechanism provided between said hanger unit and said main body for relatively rotating them about the horizontal axis.

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2. A vibrating pile driver of claim 1 comprising both a first and second rotation driving mechanism.

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3. A vibrating pile driver according to claim 1 or 2 with remote control means for operating the first rotation driving mechanism and/or the second rotation driving mechanism.

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4. A vibrating pile driver of any preceding claim in which the first rotation driving mechanism comprises:-

a motor;

a driving gear; and

a driven gear.

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5. A vibrating pile driver of any preceding claim in which the second rotation driving mechanism comprises a piston and a rocking arm.

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FIG. 1

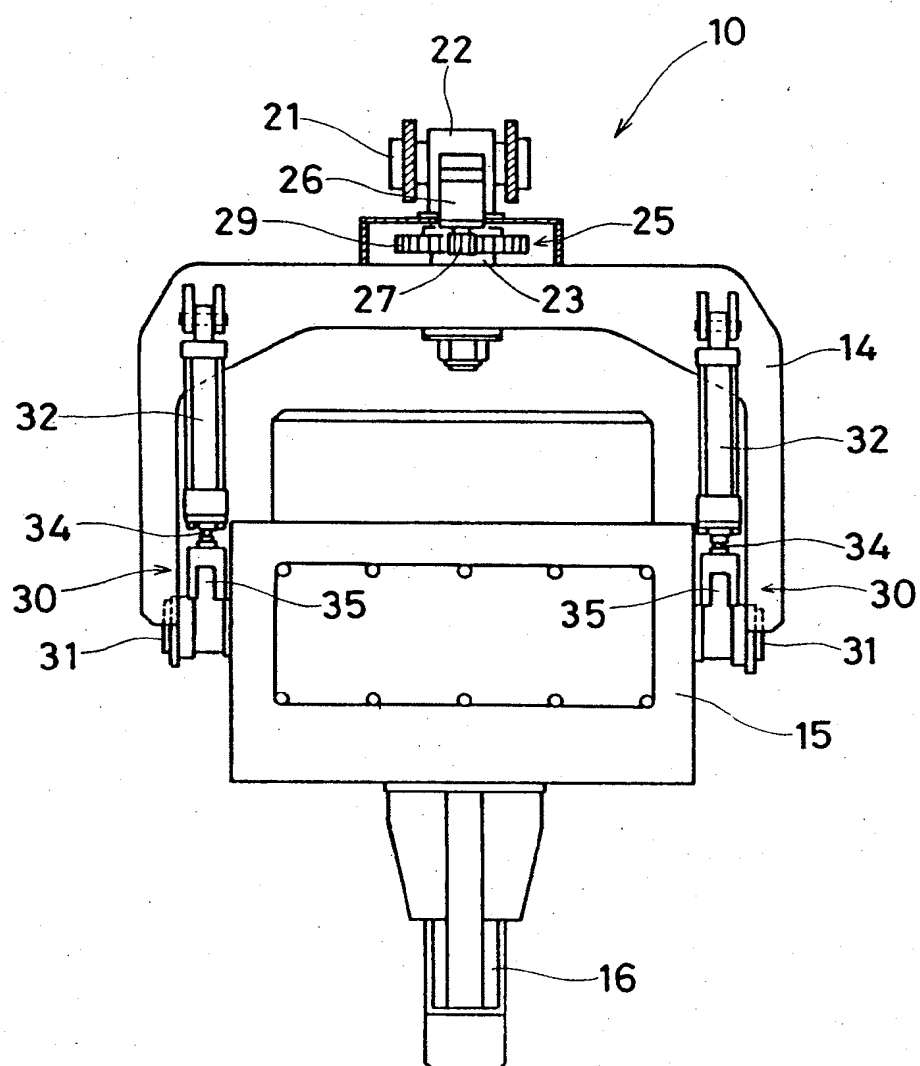


FIG. 2

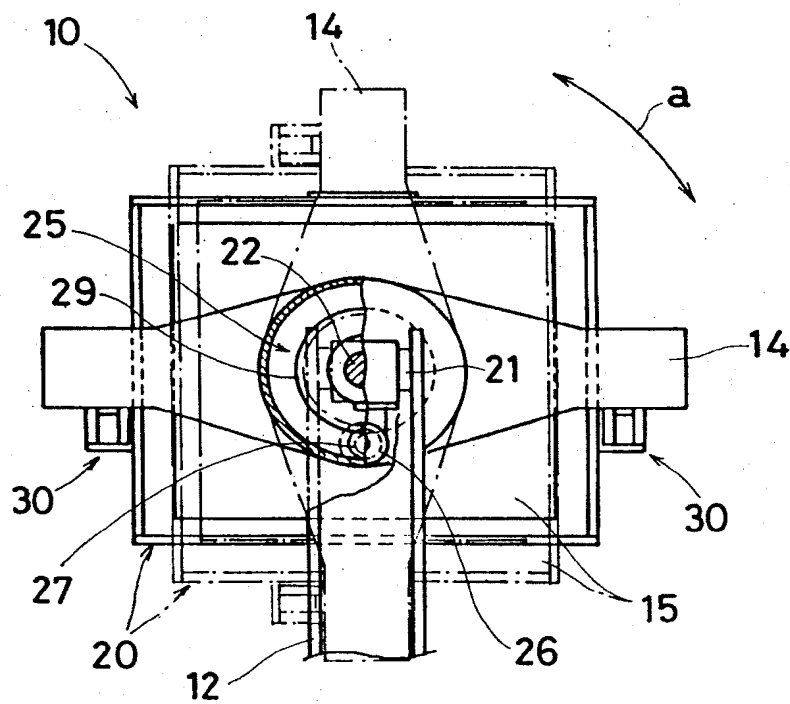


FIG. 3

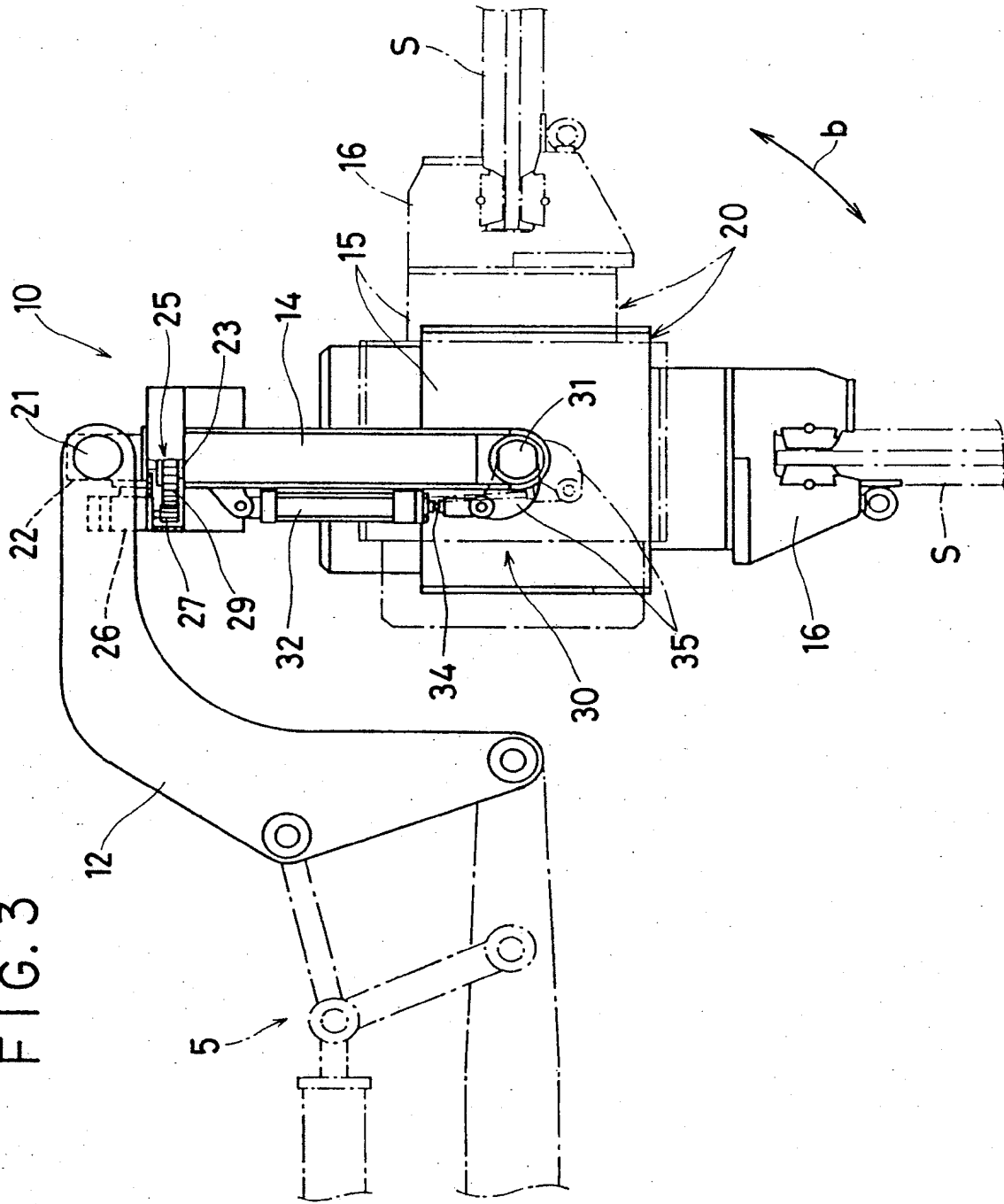


FIG. 4

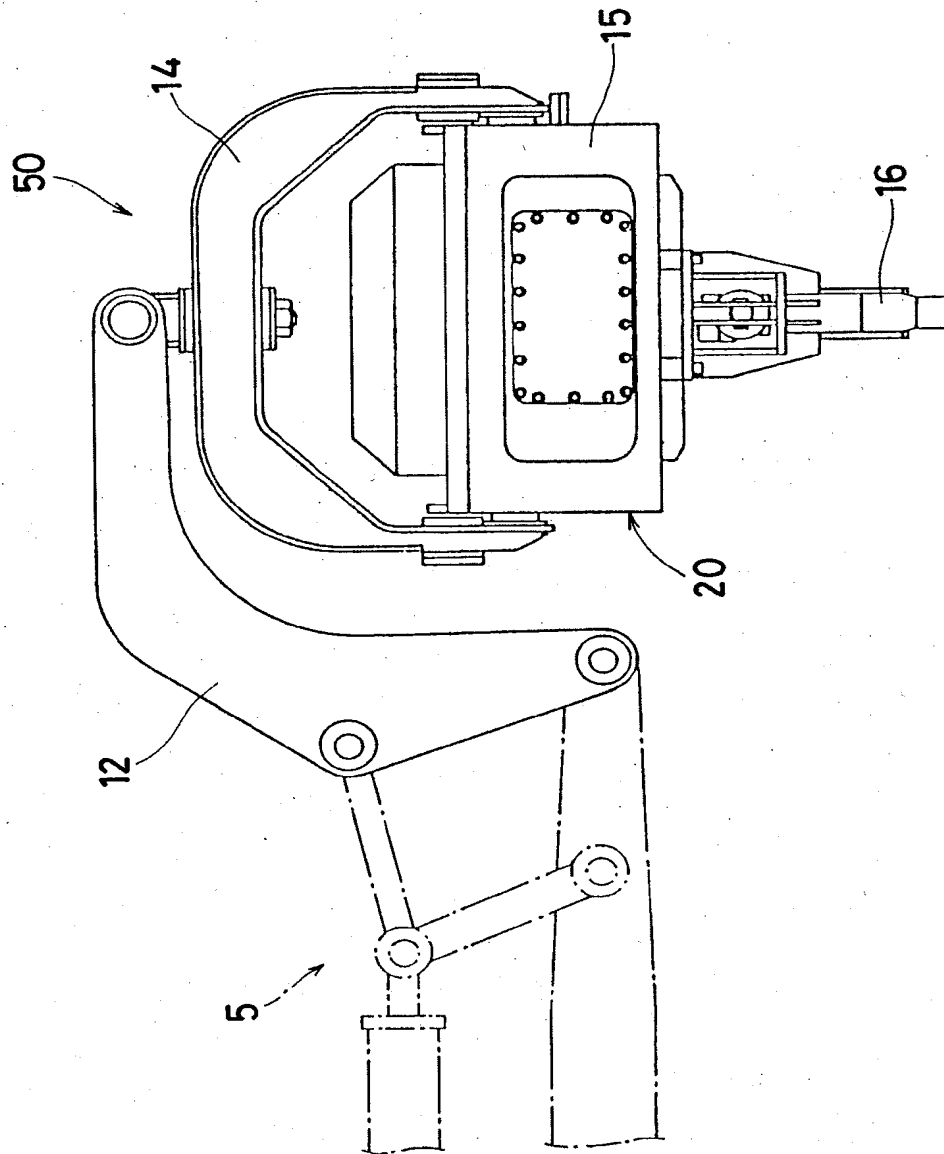
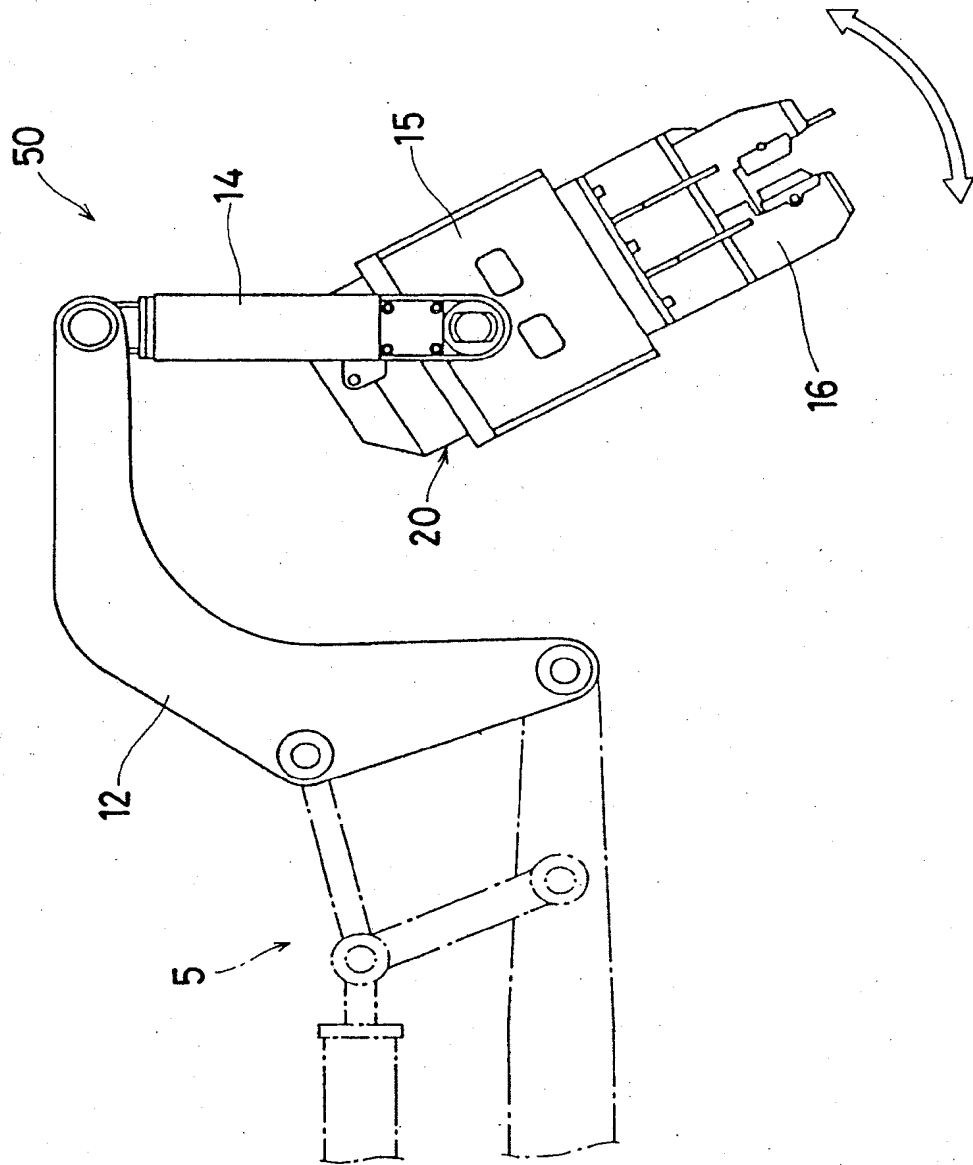


FIG. 5





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EUROPEAN SEARCH REPORT

Application Number

EP 91 31 1889

DOCUMENTS CONSIDERED TO BE RELEVANT

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	PATENT ABSTRACTS OF JAPAN vol. 6, no. 181 (M-156)(1059) 17 September 1982 & JP-A-57 089 023 (KENSETSU KIKAI CHIYOUSHA) 3 June 1982 * abstract * ----	1-5	E02011/00 E0207/18
A	US-A-3 033 394 (KASHERGEN) * column 1, line 23 - line 38 * * column 3, line 6 - line 59; figures 1-3 * ----	1,3,4	
A	DE-A-1 634 275 (BODINE) * page 14, line 1 - line 11 * * page 40, line 1 - page 43, line 18 * * page 64, line 1 - page 68, line 13; figures 1-10 * -----	1,3,4	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			E02D E02F E21B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 06 APRIL 1992	Examiner BELLINGACCI F.
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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